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ABSTRACT

Performance objectives are stated for this secondary school instructional unit concerned with aspects of earth science with emphases on the internal and external forces that bring about changes in the earth's crust. Lists of films and state-adopted and other texts are presented. Included are a course outline summarizing the unit content; numerous suggestions for experiments, demonstrations, and activities in laboratory and field; and lists of possible individual projects and discussion questions. A master sheet showing the relationship of each suggested activity to the objectives of the unit is appended in this booklet. (CC)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

GEOMORPHOLOGY

5342.09
5311.34
5312.34
5313.34

SCIENCE
(Experimental)

DIVISION OF INSTRUCTION • 1971

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Written by June P. Castaldi
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Fla.
1971

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GEOMORPHOLOGY

COURSE DESCRIPTION:

An introductory course in Earth Science stressing the internal and external forces that bring about changes in the earth's crust.

ENROLLMENT GUIDELINES:

None

STATE ADOPTED TEXTS:

1. Hibbs, Dr. A. and Eiss, Dr. A., The Earth-Space Sciences. River Forest, Ill.: Laidlaw Bros., 1971.

2. Intermediate Science Curriculum Study. Probing the Natural World Vol. 3A. Morristown, N. J.: Silver Burdett Co., 1970.

3. Oxenhorn, J. and Idelson, M. Pathways in Science-Earth Science 1. New York: Globe Book Co., 1968.

4. Thurber, W. and Kilburn, R. Exploring Earth Science. Boston: Allyn and Bacon, Inc., 1970.

PERFORMANCE OBJECTIVES

The student will:

1. Describe the general location of the earthquake belt.

2. Given sufficient background information, diagram the way two types of earthquake waves travel.

3. Given sufficient background information, explain how it is possible to obtain information about the interior of the earth.

4. Construct a model or detailed diagram of a volcano that will suggest reasons why volcanic activity is caused by forces within the earth.

5. Use the terms plain, sediment, delta, erosion and deposition correctly in discussing geologic processes.

6. Given practical experience, discuss the origin of various types of sediment.

7. Draw or construct different types of mountains that will suggest their formation and age.

8. Given practical laboratory experience, discover that moving water in rivers and streams is a major factor in the continuous removal of materials from one location to another.

9. Using a stream table, discover that running water carries with it material worn away from the land over which it has run, and this in turn forms deltas, alluvial fans, and plains.

10. Given a collection of sediment from canals, streams, and/or rivers, discover that not all sediment is produced from materials washed away from the land, but some is produced by living organisms.

11. Given various soil samples, suggest how they may have been formed.

12. Given appropriate laboratory experiences, discover that wind, water, and ice are constantly changing the Earth's surface.

COURSE OUTLINE

I. Movement of the Earth's Crust

A. Destructional Forces

1. Erosion and its effects
   a) Weathering
      (1) Types of weathering
      (2) Relationship of climate to weathering
   b) Ground water
      (1) Origin
      (2) The water table
      (3) Geologic work of ground water
   c) Surface streams
      (1) Stages of stream development
      (2) Stream flow in a channel and channel erosion
      (3) Landscape development
   d) Glaciers and glaciation
      (1) Kinds of glaciers
      (2) Movement of glacial ice
      (3) Major effects of glaciation
      (4) Theories of glaciation
   e) Wind
      (1) Factors affecting work of the wind
      (2) Ablation and abrasion
      (3) Wind deposits

2. Earthquakes
   a) Effects of earthquakes
   b) Causes of earthquakes
   c) Depth of focus and magnitude of earthquakes
   d) Prediction of earthquakes
      (1) The seismograph
      (2) Seismograms

B. Constructional Forces

1. Vulcanism
   a) Location of volcanoes
   b) Kinds of volcanoes
   c) Structure of a volcano
   d) Extrusive and intrusive vulcanism

2. Building plains, plateaus, and mountains
   a) Origin of plains
   b) Origin of plateaus
   c) Folded, faulted and volcanic mountains
   d) Life cycles

II. Formation of Soils

A. Residual soils

B. Transported soils

EXPERIMENTS/DEMONSTRATIONS

(All the activities listed are intended to be engaged in by the student. However, the extent to which this is possible is dependent upon your supplies and facilities. Therefore, the decision to have them as student activities or demonstrations is left to the teacher.)

Buschke, E. and Eiss, A. The Earth-Space Sciences. River Forest, Ill.: Laidlaw Bros., 1971.

1. Do It Yourself (earthquakes p. 238)
2. Find Out By Trying (earthquakes p. 238)
3. Find Out By Trying (seismograph p. 243)
4. Do It Yourself (seismic waves p. 246)
5. Do It Yourself (locate center of earthquakes p. 249)
6. Do It Yourself (mountains p. 303)
7. Do It Yourself (rivers p. 310)
8. Find Out By Trying (glaciers p. 311)
9. Do It Yourself (mountains p. 383)
10. Find Out By Trying (mountains p. 387)
11. Find Out By Trying (fractures p. 388)
12. Do It Yourself (weathering p. 467)

Buschke, E.; Eiss, A.; Hibbs, A. Lab Manual for Earth-Space Science. River Forest, Ill.: Laidlaw Bros., 1970.

13. A simple seismograph (Inv. 24 p. 79)
14. Using earthquake waves to locate an earthquake (Inv. 25 p. 83)
15. Evidence of glaciers (Inv. 28 p. 93)
16. Mechanical and chemical weathering (Inv. 42 p. 133)

Thurber, W.: Kilburn, R.; and Seager, D. Exploring Earth Science Record Book. Boston: Allyn and Bacon, Inc., 1970.

17. Erosion and its effects (pp. 39-41)
18. Erosion by streams (pp. 42-51)
19. Wind erosion (p. 52)
20. The nature of soils (pp. 55-59)
21. Physical changes in soils (pp. 60-64)
22. Rock folding (p. 94)
23. Effects of faulting (p. 96)
24. Forms of volcanoes (p. 97)
25. Glaciation (pp. 98-99)
26. Stream erosion and deposition (pp. 107-114)

Thurber, W. and Kilburn, R. Exploring Earth Science. Boston: Allyn and Bacon, Inc., 1970.

27. Producing abrasion (p. 91)
28. Slope and stream velocity (p. 94)
29. Stream velocity and erosion (p. 95)
30. Effect of decreased velocity (p. 98)
31. Deposits in quiet water (p. 99)

32. Erosion by streams (p. 108 #4, #5)
33. Composition of soils (p. 115)
34. Ice flow (p. 202)

Namowitz, S. and Stone, D. Earth Science-The World We Live In. Princeton, N. J.: VanNostrand Co. Inc., 1965.

35. Weathering (p. 90 #1)
36. Chemical weathering (p. 90 #3)
37. Ground water (p. 104 #1, 2, 5, 6)
38. Erosion by wind (p. 111 #1, 2)

Namowitz, S. Activities in Earth Science. Princeton, N. J.: VanNostrand Co. Inc., 1965.

39. Porosity and permeability (Ex. 12 p. 31)
40. Hard water and soft water (Ex. 13, p. 33)

Oxenhorn, J. and Idelson, M. Pathways in Science-Earth Science 1. New York: Globe Book Co., 1968.

41. Weathering (p. 89)
42. Weathering by heat (p. 90)
43. Chemical weathering (p. 91)
44. Glaciers (p. 99)
45. What type of soil absorbs water best? (p. 110)
46. What type of soil holds water best? (p. 110)
47. Hard and soft water (p. 112)

Floch, Henri. Exercises and Investigations for Modern Science. New York: Holt, Rinehart, Winston, 1965.

48. Block mountains (Ex. 29, p. 65)
49. Folded mountains (Ex. 30, p. 67)
50. Life cycle of a plateau (Ex. 32, p. 73)
51. A young plateau (p. 77, Ex. 34)
52. An inactive volcano (p. 79, Ex. 35)
53. An extinct volcano (p. 83, Ex. 36)
54. Model volcano (Inv. 23, p. 85)
55. Volcanic intrusion (Inv. 24, p. 86)
56. Water-well seismograph (Inv. 25, p. 86)
57. Weathering (Ex. 36, p. 87)
58. Erosion (Ex. 37, p. 89)
59. Stream development (Ex. 42, p. 99)
60. A river in old age (Ex. 43, p. 103)
61. The work of streams (Ex. 44, p. 105)
62. Effects of glaciation (Ex. 45, p. 107)
63. Continental glaciation (Ex. 46, p. 109)
64. Valley glaciation (Ex. 47, p. 111)
65. Wind action (Ex. 48, p. 113)
66. Mechanical and chemical weathering (Inv. 26, p. 123)
67. Survey of weathering (Inv. 27, p. 123)
68. Demonstration of character ice (Inv. 28, p. 123)
69. Survey of erosion (Inv. 29, p. 123)

Wolf, Dr. Caleb, et al. Earth and Space Science Lab Manual. Boston: Heath and Co., 1966.

70. Mechanical weathering of rocks (Ex. 6, p. 27)
71. Chemical weathering of rocks (Ex. 8, p. 33)
72. The making of streams (Ex. 15, p. 53)
73. Winds modify the surface of the earth (p. 65, Ex. 18)
74. Glaciers modify mountains (Ex. 19, p. 67)
75. Earthquakes and how to measure them (Ex. 23, p. 77)

PROJECTS/ACTIVITIES

1. Build a small seismograph and record vibrations.

2. Make a display comparing earthquakes and volcanoes. Show their effects, how they can be predicted, what they have in common, and how they are unique.

3. Construct a stream table to use in conducting experiments concerning erosion. (Design found on pp. 334-336 of American Geological Institutes Geology and Earth Sciences Sourcebook.)

4. On a map of the earth, indicate the position of the major mountain ranges, their heights, and approximate age. Is there a relationship between heights of mountains and age?

5. Conduct experiments with paraffin or other pliable material by applying pressure in different directions and observing what happens. Make sketches and relate this to crustal behavior of the earth.

6. Build a rotating drum in which you can put pieces of rock and tumble them. Use this apparatus to obtain information about erosion of rocks and the rate at which different types show wear.

7. Investigate the presence of dissolved minerals in rain water, house water, water at school, etc.

8. Build a model of a cavern out of chicken wire and plaster of Paris to show the work of ground water. Show stalagmites and stalactites, natural bridges, etc. Make it as elaborate or as simple as you wish.

9. Make cutaway models of landforms such as: plateau, folded mountain, volcano, etc.

10. Take photos of streams, lakes, canals during high, low, normal, and flood heights to show the different erosional effects.

11. Make a soil auger. Use it to study soil profiles. Prepare a map showing the area studied.

12. Study particles of soil with a microscope. Prepare slides of several soil types. Make a list of all the components identified in the soil.

13. Add two teaspoonsful of different clay samples to each of several bottles. Fill with water. Shake well and let stand for about a week. Observe daily. Keep a record of any settling into apparent layers. What does this show about clay samples?

14. Show how glacial kettles may have formed in a moraine by burying chunks of ice in a tray of sand and watching the changes as the ice melts. Then pour water into the tray to show how the kettles may become kettle ponds.

15. Collect pictures and make a display of any of the following: canyons, caves, rivers, volcanoes, mountains.

16. Make snowballs from finely crushed ice. Observe what you do to make the snowball harder and harder. Relate this to glaciers.

17. Write to the travel bureaus of different countries and ask them to send you booklets and pictures of any of the phenomena and characteristics you have studied.

    example: The Canadian Government Travel Bureau
    Ottowa, Canada

    Ask for pictures of glaciers, mountains.

18. On a map of the earth, indicate the positions of the active volcanoes of the world. Relate this to the regions of earth having frequent earthquakes, and plot the earthquakes (major ones) with their dates of occurrence.

SUGGESTION: Obtain the Teacher's Edition of Ramsey's Modern Earth Science. It contains dozens of suggested activities and projects you can adapt to your classroom needs.

REPORTS

1. A detailed report of a major earthquake that occurred within the last 10 years.
2. A study of tsunamis.
3. Earthquakes mentioned in ancient literature. How did people react and think then?
4. A study of glaciers. Prepare a chart comparing each type.
5. The geology of the area in which you live. What did it look like 100, 500, 1000, 10,000 or more years ago?
6. Write a petroleum company to find out how petroleum geologists use man-made earthquakes and seismographs to search for petroleum-bearing rock formations.
7. How man has affected the landscape by speeding up erosion.

FIELD TRIPS

1. Visit the county agricultural agent. Ask about local soil problems.
2. Visit an exposed region of sedimentary rock. Study the types of sediment.
3. Visit the Museum of Science. Study any exhibits they have dealing with geology.
4. Visit Miami Beach or some other shoreline. Report about the erosion taking place there.
5. Visit any site that will show the effects of erosion.
6. Visit the beach to study sand dunes. Observe shapes, steepness, composition, relations to wind direction, etc.
7. Visit the University of Miami Geology Department to study specimens of volcanic dust, cinder lava, tuff, and any other unusual soils, etc., not found in Miami.
8. Visit a seismic station or a museum where you can see a seismograph.
9. Visit a local water supply office. Ask them to show you maps of where your water comes from, etc.

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL SERVICES

1. Birth of a Volcano
   AV#1-01998, 19 minutes, BW
2. Birth of the Soil
   AV#1-03696, 10 minutes, C
3. Bryce Canyon National Park
   AV#1-04981, 5 minutes, C
4. Canyon Country
   AV#1-12290, 13 minutes, C
5. Cascade Mountains
   AV#1-10975, 20 minutes, C
6. Caverns and Geysers
   AV#1-10980, 14 minutes, C
7. Changing Climates
   AV#1-02078, 11 minutes, C
8. The Changing Desert
   AV#1-02056, 7½ minutes, C
9. The Colorado River
   AV#1-04979, 10 minutes, BW
10. Earth: The Changes in its Surface
    AV#1-02012, 11 minutes, C
11. The Earth: Its Structure
    AV#1-01996, 11 minutes, C
12. Earthquakes
    AV#1-02008, 11 minutes, BW
13. Earthquakes and Volcanoes
    AV#1-10956, 13 minutes, C
14. Erosion: Leveling the Land
    AV#1-10966, 14 Minutes, C
15. Eruption of Kilauea
    AV#1-30361, 27 minutes, C
16. Evidence of the Ice Age
    AV#1-10969, 19 minutes, C
17. Geological History of the Grand Canyon
    AV#1-04563, 11 minutes, C
18. Geological Works of Ice
    AV#1-02020, 11 minutes, BW
19. Geyser Melodies
    AV#1-02027, 11 minutes, C
20. Geysers and Hot Springs
    AV#1-02029, 11 minutes, C
21. Glacier Park Studies
    AV#1-12285, 15 minutes, C
22. Glaciers
    AV#1-02016, 10 minutes, BW
23. The Great Lakes: How They Were Formed
    AV#1-00856, 11 minutes, C
24. Ground Water
    AV#1-02030, 11 minutes, BW
25. The Hot, Dry Desert
    AV#1-10983, 16 minutes, C

26. In The Beginning
AV#1-30356, 28 minutes, C
27. Lava and the River
AV#1-10962, 20 minutes, C
28. Mount Rainier
AV#1-02017, 11 minutes, C
29. The Mountain of Fire
AV#1-02000, 10 minutes, C
30. Mountains on the Move
AV#1-02054, 11 minutes, C
31. Our Soil Resources
AV#1-03703, 10 minutes, BW
32. Parcutin
AV#1-13097, 23 minutes, BW
33. River of Ice: Life Cycle of a Glacier
AV#1-02038, 10 minutes, C
34. The River
AV#1-30760, 32 minutes, BW
35. Secrets of the Ice
AV#1-30363, 29 minutes, C
36. The Story of Soil
AV#1-03708, 11 minutes, BW
37. Understanding Our Earth: Glaciers
AV#1-02023, 10 minutes, BW
38. Understanding Our Earth: How Its Surface Changes
AV#1-02018, 10 minutes, BW
39. Understanding Our Earth: Soil
AV#1-03706, 10 minutes, BW
40. Volcano
AV#1-10964, 18 minutes, BW
41. Volcano
AV#1-02001, 10 minutes, C
42. Volcanoes in Action
AV#1-02003, 11 minutes, BW
43. Water
AV#1-05596, 11 minutes, BW
44. Water Supply
AV#1-03582, 10 minutes, C

SUGGESTED DISCUSSION QUESTIONS

1. Why are marine fossils often found in mountainous areas?
2. What are the principle causes of earthquakes?
3. Describe the characteristics of young, mature, and old mountains.
4. What explanations can you give concerning the formation of marine mountains?
5. What conditions usually result in the formation of canyons?
6. Discuss the various types of lava.
7. Why do geologists believe Meteor Crater is not of volcanic origin?
8. Explain the difference between intrusive and extrusive vulcanism and their results.
9. Geologists predict that someday the New England area may experience earthquakes. Why?
10. Discuss conditions under which a landform may never complete its life cycle.
11. Power plants are usually built more frequently in young mountain areas than in mature or old. Why?
12. Explain the difference between residual soils and transported soils.
13. What is the relationship of climate to weathering and erosion?
14. What factors determine the nature and size of a stream load? What causes a stream to deposit its load?
15. Compare glaciers and streams as to erosion, transportation, and deposition.

REFERENCES

1. Buscke, E.; Eiss, A.; Hibbs, A. Lab Manual for the Earth-Space Sciences. River Forest, Ill.: Laidlaw Bros., 1971.

2. Floch, Henri. Exercises and Investigation for Modern Earth Science. New York: Holt, Rinehart, Winston, 1965.

3. Hibbs, Dr. A. and Eiss, A. The Earth-Space Sciences. River Forest, Ill.: Laidlaw Bros., 1971.

4. Namowitz, S. Activities in Earth Science. Princeton, N. J.: Van Nostrand Co., 1965.

5. Namowitz, S. and Stone, D. Earth Science-The World We Live In. Princeton, N. J.: Van Nostrand Co., 1965.

6. Oxenhorn, J. and Idelson, M. Pathways in Science - Earth Science 1. New York: Globe Book Co., 1968.

7. Ramsey, W. and Burckley, R. Modern Earth Science. New York: Holt, Rinehart, Winston, 1965.

8. Stanger, Robert. Work-A-Text in Earth Science. Bronxville, New York: Cambridge Book Co., 1967.

9. Thurber, W. and Kilburn, R. Exploring Earth Science. Boston: Allyn and Bacon, Inc., 1970.

10. Thurber, W.; Kilburn, R. and Seager, D. Exploring Earth Science Record Book. Boston: Allyn and Bacon, Inc., 1970.

11. Wolfe, Dr. C., et al. Earth and Space Science Lab Manual. Boston: Heath and Co., 1966.

MASTER SHEET - GEOMORPHOLOGY

Objectives	Experiments/ Demonstrations	Projects/ Activities	Reports	Field Trips	Films	Discussion Questions
1	1, 2	18	1, 3	3	12, 13	9, 2
2	3,4,5,13,14,23, 56,75	1	2, 6	8	12, 13	
3	1,2,11,52,53,55	2, 5	6, 5	3, 8	6,10,11,13,41	
4	24,52,53,54,55	2, 9, 15		3	1,15,26,27,29, 32,40,42,41	6, 7, 8
5	7,26,28,29,30,31, 58,59,61,69	10, 15	7	2, 3, 4, 5		10, 5
6	17,18,20,26,31,58, 60,67,69	10, 11, 12		4, 5, 7	36, 39	12
7	6,9,10,22,48,49, 50,51,74,23	4,5,9,15,17	5	3	5, 28, 30	3, 4, 11, 1
8 and 9	7,12,16,17,18,26, 27,28,29,30,31,32, 35,36,40,41,43,47, 57,58,59,60,61,66 70,71,72,37	3,6,7,8,10,15	7	1,2,4,5, 9	4,6,9,14,17, 19,20,23,24, 34,43,44,2	13, 14
10 and 11	20,21,26,33,38,39, 42,45,46,62,65,69	11,12,13,15		1, 8, 6	14,31,36,39	12
12	8,15,19,25,34,38, 44,62,63,64,68,73, 74	14, 16, 17	4	6, 12	3,7,8,16,18, 21,22,25,33, 35,37,38	15